



(19)

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 1 052 421 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

15.11.2000 Bulletin 2000/46

(51) Int. Cl.⁷: F16D 25/10

(21) Application number: 00109571.0

(22) Date of filing: 04.05.2000

(84) Designated Contracting States:

AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE

Designated Extension States:

AL LT LV MK RO SI

(30) Priority: 12.05.1999 DE 19921687

(71) Applicant:

Borg-Warner Automotive GmbH
68755 Ketsch (DE)

(72) Inventors:

- Merkel, Harald
74889 Sinsheim (DE)
- Bradford, Thomas Edward Jr.
Brighton MI 48114 (US)

(74) Representative:

Dr. Weitzel & Partner
Friedenstrasse 10
89522 Heidenheim (DE)

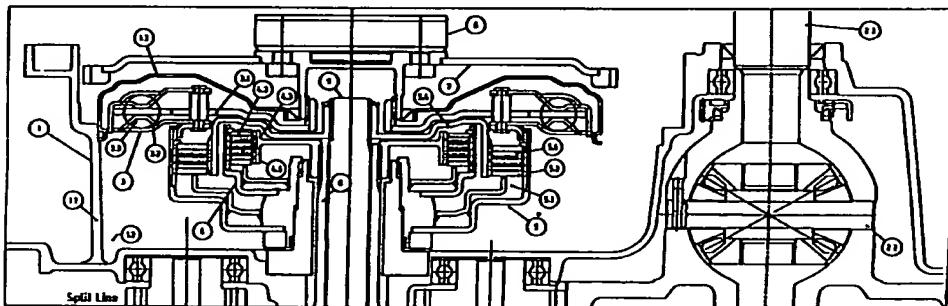
(54) Multiple clutch system for a transmission

(57) The invention involves a multiple clutch (1) system for a transmission;

with two multi-disk clutches (4,5) that are coaxial with each other;
each clutch is assigned to one of two shafts, of which the one is a hollow shaft and encloses the other;
one of the two clutches is connected to the hollow shaft, and the other to the inner shaft so they are

torsionally fixed;

A torsional oscillation damper (3) is connected to the two clutches. It has two centrifugal masses (3.1,3.2), which on their part can rotate circumferentially against each other;
one of the two centrifugal masses is connected to the bell (5.3) of the one of the two clutches so that it is torsionally fixed.



EP 1 052 421 A1

Description

[0001] The invention concerns a multiple clutch system for a transmission, specifically a double clutch system for an auxiliary range transmission.

[0002] There have been numerous double clutch systems publicized, where one of the clutches is used for starting up, and both are used for changing gears when powershifting into an intermediate gear.

[0003] DE 35 26 630 A1 describes a double clutch for alternately coupling a central shaft and a hollow shaft that is concentric to it. This double clutch is meant for a speed change gear of a motor vehicle. A clutch disk connected to the central shaft on the one side, and a clutch disk connected to the hollow shaft on the other side can be pressed against a plate of the revolving clutch casing.

[0004] DE 43 32 466 A1 describes a double multi-disk clutch, enclosing a powered, revolving casing. Here also the two inner disk assemblies are each connected to a separate center member, so they are torsionally fixed. The one center member is torsionally fixed on one shaft, and the other center member torsionally fixed on a hollow shaft that is concentric to it. Both clutches are encased in each other, so that the one clutch surrounds the other, in order to reduce the axial design space.

[0005] The double clutch principle that was introduced, with a hollow shaft and inner shaft that is enclosed by it, can be advantageously utilized with auxiliary range transmissions. In particular, the shifting thrust during gear changes can be minimized to zero, and an interruption in propulsive power can be avoided.

[0006] However, multiple clutch systems of the kind mentioned are in need of improvement. The disadvantage is that they can't be utilized in and combined with a larger number of transmission types and designs. Among other things, one contraindication is that numerous auxiliary units, such as oil pumps, filters, oil containers, sensors, solenoid valves, control valve assembly, electronic control, are distributed across the entire transmission.

[0007] The invention is based on the assignment to create a multiple clutch system of the kind described at the outset, so that it forms an extensive, self-sufficient unit, which can be easily combined with a variety of transmissions with different designs and sizes, and in addition, leads to a reduction of design space, weight and manufacturing costs.

[0008] This assignment is fulfilled by the characteristics of Claim 1. With it, the inventors have made an intelligent selection from the variety of combination possibilities. The system based on the invention represents a modular constructional unit. It incorporates at least the most important, if not all, the auxiliary units mentioned, that have been spread across the entire transmission in the past. Above all, it can be used with manual transmissions. An especially large, effective centrifugal mass is created through the torsionally fixed

union of one of the two centrifugal masses of the torsional oscillation damper with the bell of one of the two clutches and the components connected to it. The constructional unit can be completely pre-manufactured, pre-assembled and pre-tested, so that it can be delivered to the transmission manufacturer or the vehicle manufacturer with a quality certificate.

[0009] The invention is further explained in the drawing. The following details are represented:

[0010] Diagram 1 shows a double multi-disk clutch component with the corresponding auxiliary range transmission, based on the invention.

[0011] Diagram 2 shows the component in diagram 1 based on the invention, in an enlarged representation.

[0012] Diagram 3 is a top view of the object in diagram 2, shown from the engine side.

[0013] Diagram 4 shows a component with the corresponding transmission based on the invention, in a schematic representation

[0014] The object shown in diagram 1 contains the double clutch system 1 based on the invention, assembled together with the auxiliary range transmission 2. System 1 contains as important components a torsional oscillation damper 3, a radial inner multi-disk clutch 4 as well as a radial outer multi-disk clutch 5. Both clutches 4, 5 are enclosed inside each other. They are slightly shifted towards each other in an axial direction. The measurement of the shift could, however, also be different. Therefore, the two clutches 4,5 could completely overlap each other in an axial direction, or in contrast to this, lie completely apart axially.

[0015] With the double clutch unit 1 based on the invention, there is a chamber 1.2. This is sealed so it is leakproof for liquids, mainly by the wall 1.1 of the clutch unit 1 as well as the partition 1.3. In chamber 1.2 there are — not shown here — several auxiliary units such as oil pumps with filters, the electronic control device, the solenoid valves and the control valves to set or regulate the amount of oil, the oil container and, if applicable, other components.

[0016] There is a flange 6, in which torque from an internal combustion engine is introduced. Flange 6 is connected to a flywheel 7 so that it is torsionally fixed. In addition, it is connected to a centrifugal mass 3.1 of the torsional oscillation damper 3 so that it is torsionally fixed. The second centrifugal mass 3.2, in contrast to the first centrifugal mass 3.1, can rotate circumferentially (limited angles) using springs 3.3.

[0017] Moreover, both multi-disk clutches each enclose inner disks 4.1, 5.1 and outer disks 4.2, 5.2. The inner disks 4.1 of the radial inner clutch are connected to a hollow shaft 8 by a hub 4.3 so that they are

torsionally fixed. The inner disks 5.1 of the outer clutch 5 are connected to the inner shaft 9 by a hub 5.4 so that they are torsionally fixed. The inner shaft 9 is enclosed by the hollow shaft 9.

[0014] An important characteristic is that the bell 5.3 of the outer clutch 5 is connected to the second centrifugal mass 3.2 of the torsional oscillation damper so that it is torsionally fixed. The second centrifugal mass 3.2 of the torsional oscillation damper is markedly enlarged by this, so that an effect similar to a two mass flywheel is created.

[0015] The transmission 2 does not require a detailed description, since it is not an object of the actual invention. There is a transmission casing 2.1, a differential 2.2, as well as a transmission driven shaft 2.3.

[0016] In diagram 2 the double clutch system 1 based on the invention is again represented by itself.

[0017] In the representation based on diagram 3, there are the following components:

two gear shafts 2.5, 2.6, an oil pump 20, a control valve assembly 21, solenoid valves 22, 23, 24, 25, a hydraulic slide 26, a driving wheel 27 for the oil pump 20.

[0018] In the schematic represented in diagram 4 there are, on the other hand, the two clutches 4 and 5, the hollow shaft 8 and the inner shaft 9, as well as gear wheel units 30-34.

damper (3), but also the two clutches (4, 5) are arranged in a sealed chamber (1.2), which contains lubricating oil.

5 4. Clutch system based on Claim 1 to 3, identified by the fact that the two clutches (4, 5) are enclosed inside each other, so that the one (5) of the two clutches is located radially outside of the other (4).

10 5. Clutch system based on Claim 1 to 4, identified by the fact that at least two of the following elements are arranged in the sealed chamber (1.2)

15 an oil pump (20)
a control valve assembly (21)
solenoid valves (22, 23, 24, 25)
a hydraulic slide (26) to regulate the volume of an electronic control

20 6. Clutch system based on Claim 1 to 5, identified by the fact that a casing (1.1) is expected.

25 7. Clutch system based on Claim 5 or 6, identified by the fact that several or all of the listed elements are arranged in the sealed chamber (1.2) surrounded by the bell (5.3) of the radial outer clutch (5), the casing (1.1) of the clutch system and the second centrifugal mass (3.2).

30

35

1.1 with two multi-disk clutches (4, 5) that are coaxial with each other;

1.2 each clutch (4, 5) is assigned to one of two shafts (8, 9), of which the one (8) is a hollow shaft and encloses the other (9);

1.3 one (4) of the two clutches (4, 5) is connected with the hollow shaft (8), and the other (5) with the inner shaft (9);

1.4 A torsional oscillation damper (3) is connected to the two clutches (4, 5). It has two centrifugal masses (3.1, 3.2), which on their part can rotate circumferentially against each other;

1.5 one (3.2) of the two centrifugal masses (3.1, 3.2) is connected to the bell (5.3) of one (5) of the two clutches (4, 5) so that it is torsionally fixed.

40

45

50

2. Clutch system based on Claim 1, identified by the fact that two clutches (4, 5) are expected.

55

3. Clutch system based on Claim 1 or 2, identified by the fact that not only the torsional oscillation

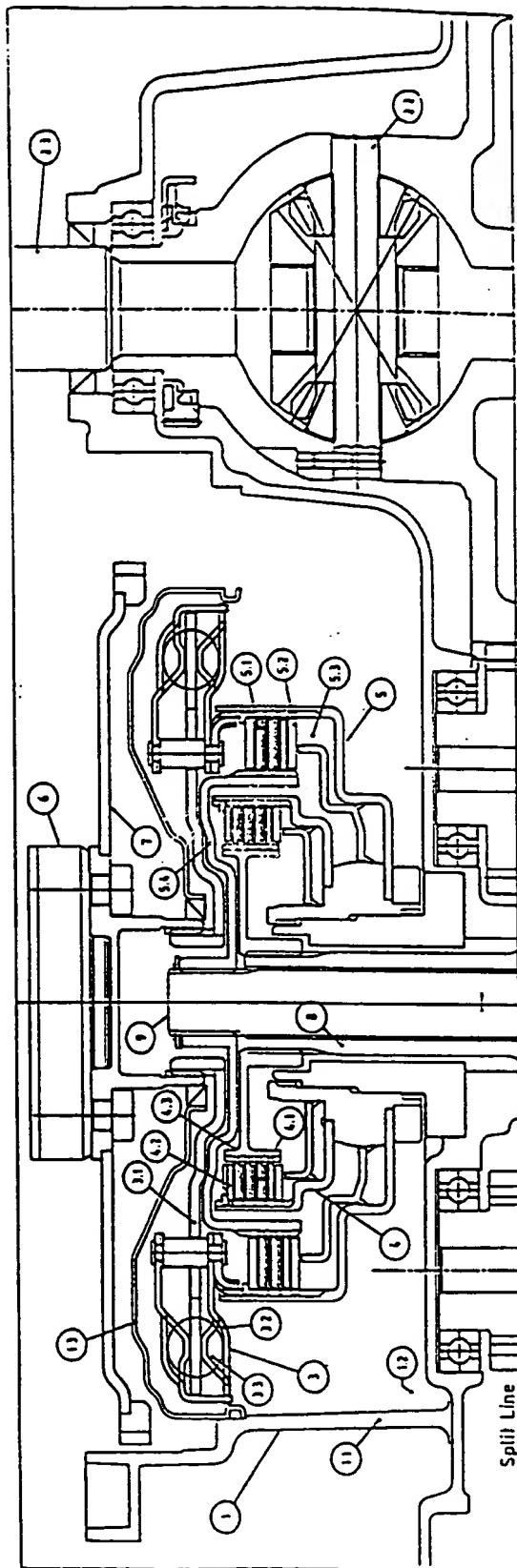


Fig. 1

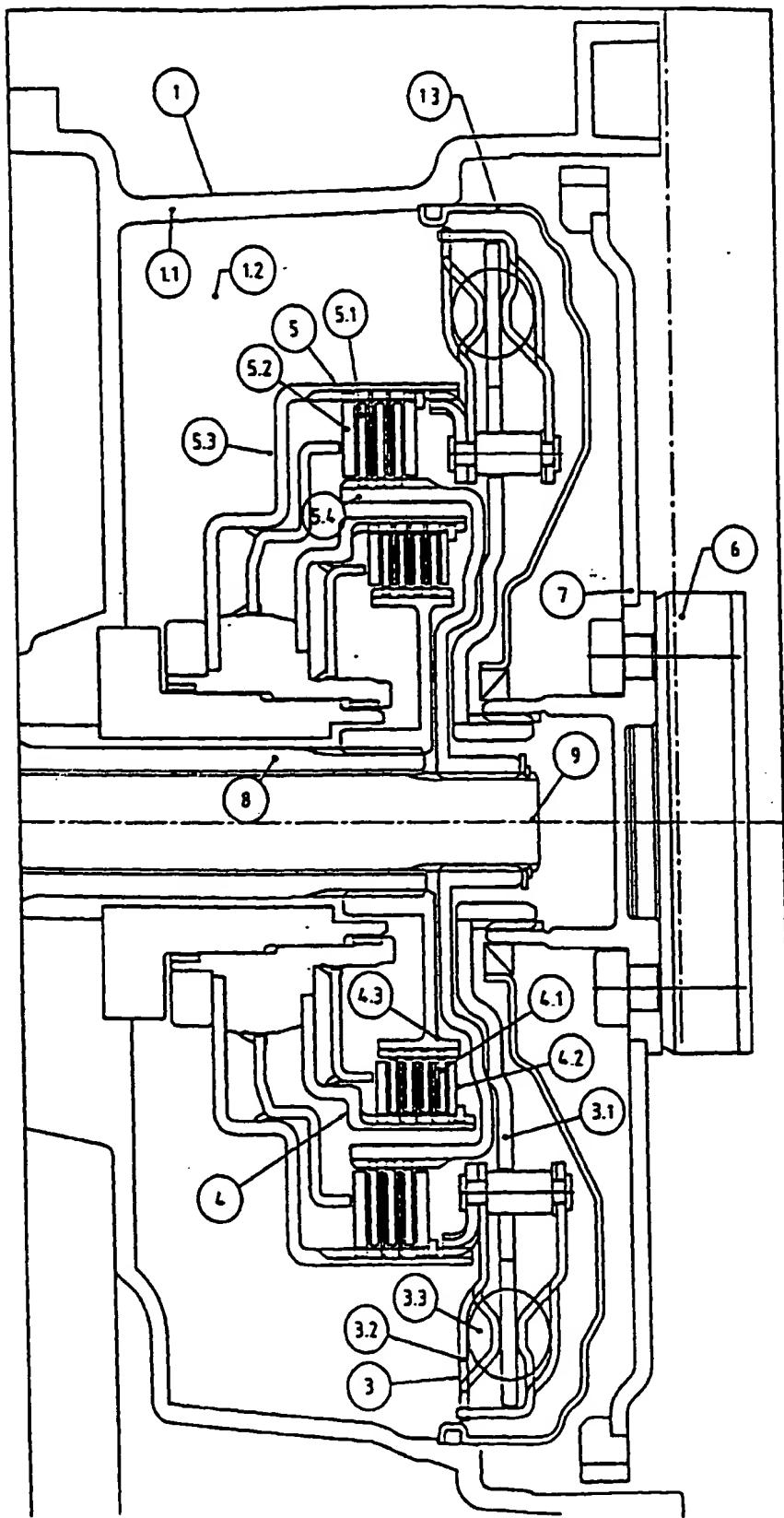


Fig. 2

Fig. 3

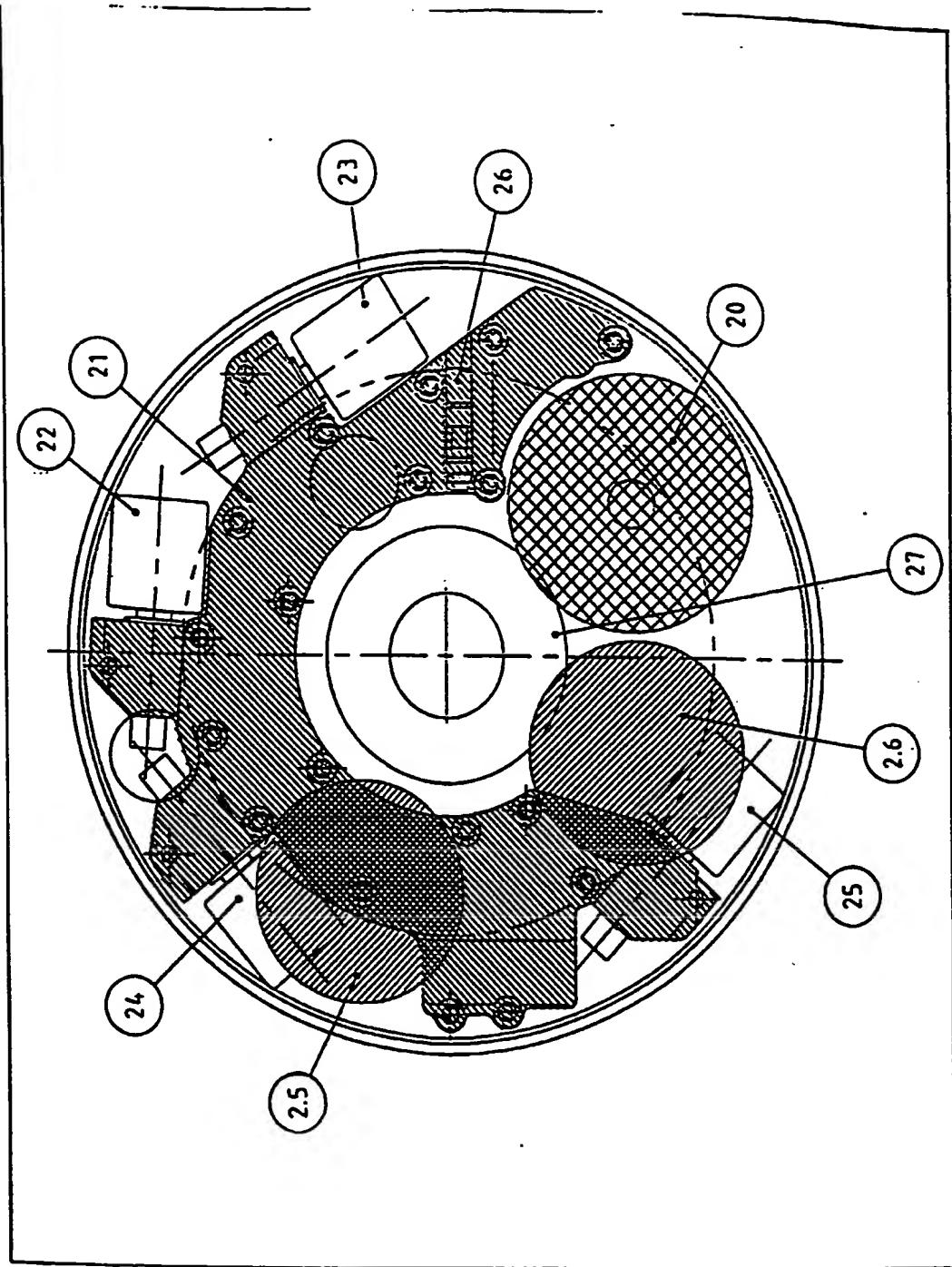
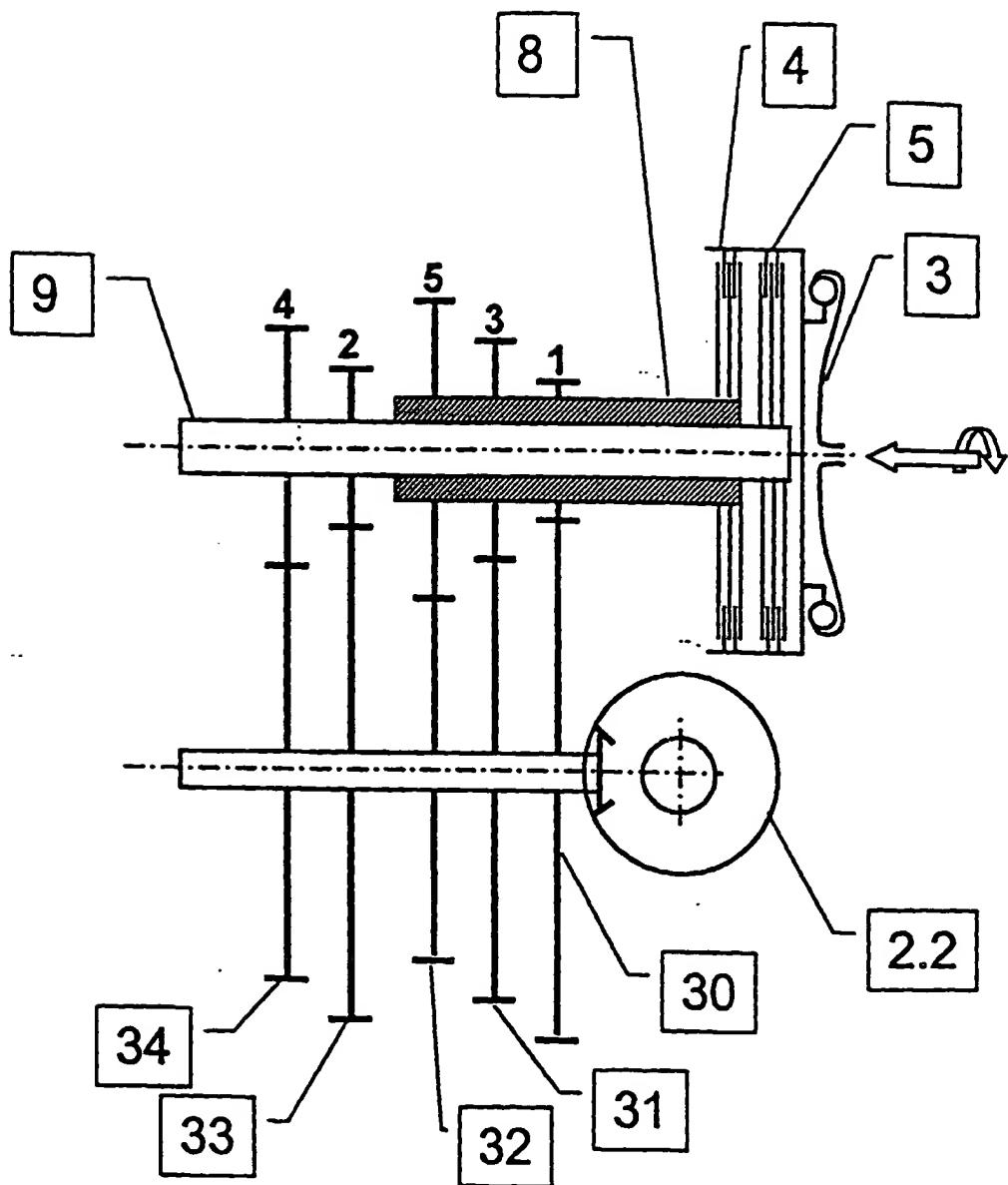


Fig. 4





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 10 9571

DOCUMENTS CONSIDERED TO BE RELEVANT					
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)		
Y	DE 37 21 706 A (LUK LAMELLEN & KUPPLUNGSBAU) 7 January 1988 (1988-01-07) * column 5, line 2 - column 6, line 63 * * figure 1 *	1	F16D25/10		
Y	US 3 589 483 A (SMITH PAUL J) 29 June 1971 (1971-06-29) * column 5, line 57 - column 6, line 51 * * figures 1,2 *	1			
A	US 4 732 253 A (HIRAMATSU TAKEO ET AL) 22 March 1988 (1988-03-22) * column 3, line 52 - column 4, line 12 * * column 4, line 47 - column 6, line 12 * * figures 1A,2 *	3,4			
A	DE 91 14 528 U (ZAHNRADFABRIK FRIEDRICHSHAFEN) 13 February 1992 (1992-02-13) * page 3, line 23 - page 4, line 4 * * page 5, line 12 - line 21 * * figure 1 *	3,5,7	TECHNICAL FIELDS SEARCHED (Int.Cl.7)		
A	EP 0 702 171 A (HONDA MOTOR CO LTD) 20 March 1996 (1996-03-20) * page 3, line 23 - line 38 * * figure 2 *	3-5,7	F16D		
The present search report has been drawn up for all claims					
Place of search	Date of completion of the search	Examiner			
THE HAGUE	29 August 2000	Vermander, W			
CATEGORY OF CITED DOCUMENTS					
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document					
T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons B : member of the same patent family, corresponding document					

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 00 10 9571

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-08-2000

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
DE 3721706	A	07-01-1988	FR	2601101 A	08-01-1988
			JP	2798385 B	17-09-1998
			JP	63026424 A	04-02-1988
			US	4813524 A	21-03-1989
US 3589483	A	29-06-1971	DE	2103812 A	05-08-1971
			FR	2077050 A	15-10-1971
			GB	1321522 A	27-06-1973
			SE	358941 B	13-08-1973
US 4732253	A	22-03-1988	JP	2060699 C	10-06-1996
			JP	7081594 B	30-08-1995
			JP	62052249 A	06-03-1987
			KR	9000392 B	25-01-1990
DE 9114528	U	13-02-1992	NONE		
EP 0702171	A	20-03-1996	JP	8061393 A	08-03-1996
			DE	69505766 D	10-12-1998
			DE	69505766 T	25-03-1999
			US	5662198 A	02-09-1997

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.